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A Standardized Data Structure for Describing and Exchanging Data from Remeasured Growth and Yield Plots

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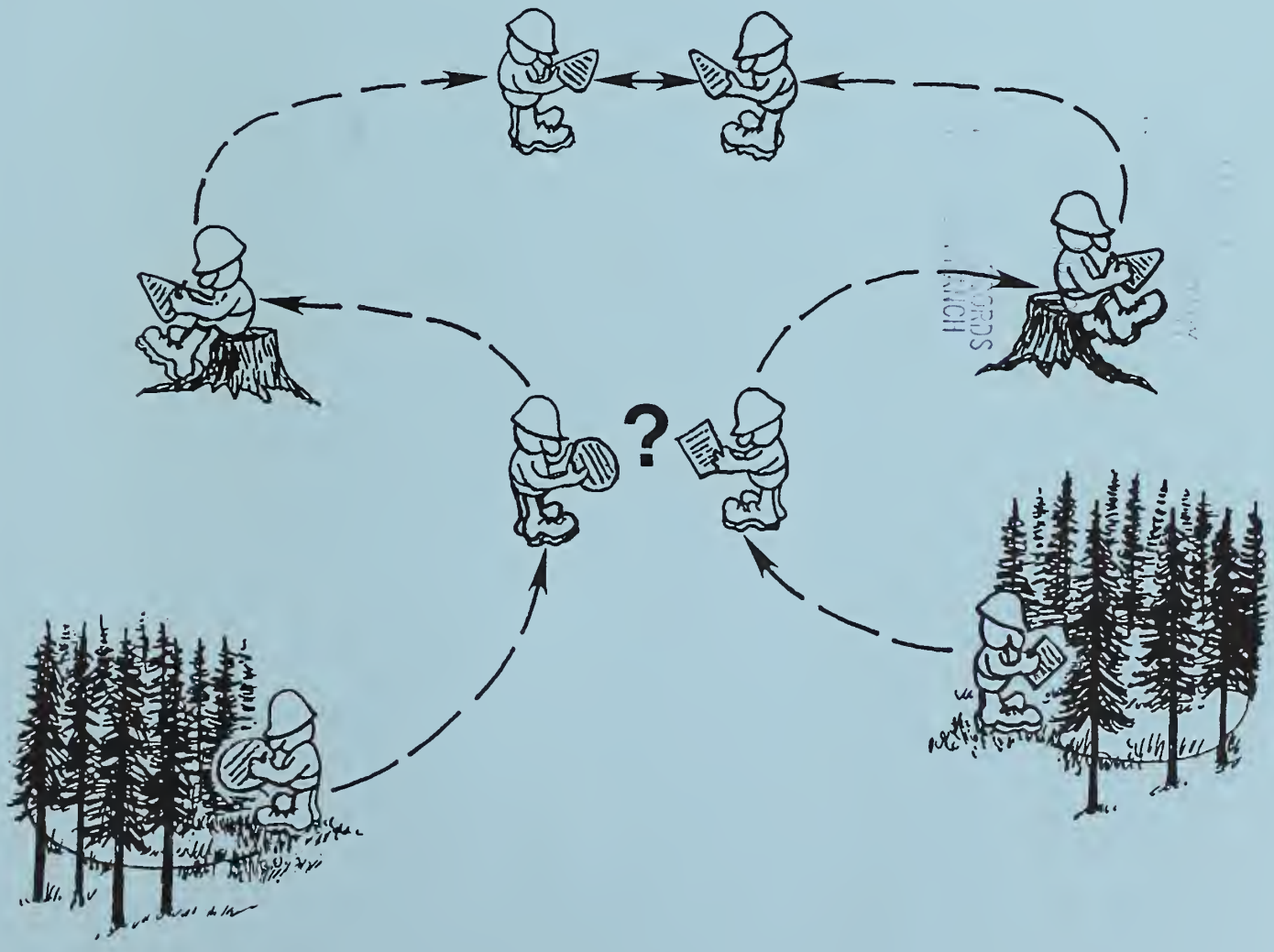

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In the early 1970's James Arney and others at Weyerhaeuser Company and Jill Hoopes and Robert Curtis of the Pacific Northwest Forest and Range Experiment Station (PNW) designed a series of programs for processing permanent plot data. In 1976, Don Reimer, employed with MacMillan-Bloedel, chaired the Western Forestry and Conservation Association's Committee on Standards of Measure and Data Sharing (COSMADS). The COSMADS format, maintained by the British Columbia Ministry of Forests, provided a basis for PNW's Plot Data Management System (PDMS). Gary Clendenen's and Robert Curtis' documentation of PNW's PDMS data formats, James Arney's knowledge of the original Weyerhaeuser-PNW project, and Frank Hegyi's documentation of the COSMADS data formats provided a sound foundation for the development of this data structure. We are strongly indebted to those who preceded us. Major support for this study was provided by the Inland Northwest Growth and Yield Cooperative (INGY) through a cooperative agreement with the University of Montana School of Forestry's Mission-Oriented Research Program and the Intermountain Research Station, Moscow, ID.

RESEARCH SUMMARY

Collectively, public agencies and private industry are currently maintaining a large number of permanent growth and yield research plots. To facilitate the sharing of plot data for the development, testing, and improvement of tree or stand growth models, standard data definitions and formats are required to maintain data integrity. Since the 1970's, standards for documenting permanent plot data have generally been available, but have lacked the capability to fully describe sampling designs, measurement methodologies, individual tree characteristics, and treatment histories. We propose a data structure that addresses these deficiencies and that provides a standardized format for the exchange of permanent plot data.

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INTRODUCTION

In 1986, the Inland Northwest Growth and Yield Cooperative funded a project to develop a database of forested permanent growth and yield plots for the purpose of testing and improving growth and yield models. This required merging data from a variety of cooperators, each with its own measurement standards and data definitions. To expedite development of the database, maintain data integrity, and provide a foundation for communicating data needs, common definitions and formats had to be agreed upon. The objectives in establishing standardized data formats and definitions were:

1. To define a data structure, independent of hardware and software, that easily allows cooperators to exchange and analyze permanent plot information.
2. To develop data formats and definitions that allow for varying sampling designs, English or metric measurement units, and varying degrees of measurement precision.
3. To define a data structure that does not require, but allows for, tree-level information at each measurement period.
4. To provide a data structure that can be readily expanded to accommodate existing or new information as needs change.

The primary geographic area of interest includes Montana, northern Idaho, eastern Washington, Alberta, and interior British Columbia. This data structure was designed for research and monitoring plots (USDA Forest Service 1990) and may not be suitable for remeasured inventory plots. The data definitions and formats presented here were developed through a cooperative effort among the University of Montana Mission-Oriented Research Program; the Intermountain Research Station's Forestry Sciences Laboratory at Moscow, ID; and members of the Inland Northwest Growth and Yield Cooperative.

EXISTING DATA STRUCTURES

In the early 1970's the Weyerhaeuser Company and the Pacific Northwest Forest and Range Experiment Station initiated an effort to develop a common permanent-plot database to support the construction of Douglas-fir yield tables. Included in this effort was the development of a series of computer programs for data management and analysis. In 1977, the Western Forestry and Conservation Association's Committee on Standards of Measure and Data Sharing (COSMADS) expanded on the initial database effort by cataloging permanent plots in the Pacific Northwest and setting standards for permanent sample plots (Arney and Curtis 1977). COSMADS first recognized the role of a standardized format as an intermediary or translator between a donor's format and a receiver's format. COSMADS also noted that standardized formats serve only as guidelines, not absolutes. Standardized data formats must be adaptable to the needs of an organization, but in return each organization must see the "greater good" of developing common data sets.

The COSMADS data formats and database are currently maintained by the British Columbia Ministry of Forests. In 1981, Curtis and Clendenen (1981) began to integrate the computer programs developed in 1970 for the Douglas-fir yield tables into a Plot Data Management System (PDMS). Each of these efforts provided a sound foundation for the Inland Northwest Growth and Yield Cooperative to build on, but none of the existing data structures fully met the objectives of this project. Previous data structures lacked the capability to fully describe different sampling designs, measurement methodology, individual tree characteristics, and treatment history. Appendix G presents a summary comparison of the data structure presented here and the COSMADS and PDMS formats.

OVERVIEW

Record and Field Descriptions

The data structure described here logically groups related information into "records." Each record is limited to 80 columns in length for ease in viewing on a standard video display or printer. This feature is particularly advantageous when exchanging information. COSMADS recognized that forest growth data were a "highly dynamic, distributed, large volume data set," which prohibited the development of a centralized data bank. In the absence of centralized data management, ease in exchanging information had to be given top consideration. A maximum record length restriction of 80 columns was limiting for only a few records. Overall, a limit on record size proved to be advantageous because it forced the grouping of data fields into manageable subsets.

Each record begins with a series of fields that identify to which stand or plot the information belongs. This "identifier" is followed by a three-digit code, called a "record type," which references what kind of information is contained in the remainder of the record.

The records are grouped into three major categories—core, supplemental, and individual tree. The "core" records document sampling design, administrative descriptors, geographic location, plot descriptors, plot summary information, measurement dates, treatment, and site descriptors. COSMADS recognized the proprietary nature of permanent growth data and defined the need for a reference file or catalog approach that did not include tree-level data. In essence, the core records defined in this paper are equivalent to the COSMADS reference file approach. Full completion of the core records is considered essential if a user is to assess the utility of a particular plot without accessing the tree data. If a specific core record is missing, the user might assume no information exists for that record and reject it for analysis, when in fact, the information was available but not supplied. Supplemental records augment information in the core records. They are defined for soils, climate, height/d.b.h. regression coefficients, and administrative units. The individual tree records contain detailed information on each tree measured.

All information within a record occurs in contiguous, fixed-field (fixed-column) format. Fields within a record are defined sequentially from left to right and begin with column 1. Each field within a record is described by a field label, data format, and description. The field label is a descriptive name for the data field. The data format is defined by a single character indicating the data type, followed by a digit indicating the maximum width of the data field. The data format for numeric fields are preceded by an "N" (N5), and character fields are preceded by a "C" (C4). If the numeric field is intended for real numbers rather than integers, the field width is followed by a decimal point and a digit indicating the maximum number of acceptable decimal places following the decimal point. For example, a numeric field for real numbers with a data format of N5.2 allows for two digits to the left of the decimal, the decimal point, and two digits to the right of the decimal for a total field width of five.

Within a field, all numeric data (integers and real numbers) are right-justified in the field, and all character data are left-justified. For real numbers, the decimal point occupies one column in the field and is always included to prevent errors

when data are translated into other formats or accessed by other software. Dates always appear in the ANSI (1977) standard format of year, month, day to avoid confusion between the different date formats used in the U.S. and Canada. Except where logical and clearly stated, zeros and blanks are considered missing information.

Stand and Plot Identification

Each plot is referenced by a unique identifier. This identifier, termed a "key," occurs at the beginning of each record and is formed by concatenating five numeric fields together. The fields that comprise the key and their formats are described below. The key is numeric for three reasons—it is compact, easily adaptable to iterative data processing such as sorting, and can be used to "mask" plot identification when exchanging proprietary data.

Each record is internally referenced and uniquely identified by including this key in the first 14 columns. For example, if all records were grouped into one file or a relational database structure was used, this key would allow the user to quickly identify all records belonging to a single plot, stand, or installation. For users who would like to cross-reference this key to another type of identifier, or carry a more readable identifier within the database, the administrative units record (record type 230) is available.

Field name	Format	Description
Source	N2	The source is a user-defined numeric code that uniquely identifies all information associated with a particular contributing organization. All records for a single organization have the same source code. Any organization receiving information can reassign this code to maintain the uniqueness of the key within their own database.
Installation	N4	An installation number identifies a logical grouping of stands, typically limited to a specific geographic locality. Each installation number is unique within a source.
Stand	N2	A stand is defined as an area of ground with relatively uniform conditions and a unique treatment combination. Each stand number must be unique within an installation.
Plot	N4	The collection of trees included within a single sampling unit. For fixed area plots, the sampling unit includes all trees within a circumscribed area. For variable radius plots, the sampling unit is the specific set of trees about a point. Each plot number is unique within a stand.
Subplot	N2	Defines a sub-sampling scheme for a plot. Subplots lie within a plot and may or may not utilize the same plot center. All subplots have the same plot number.

The fields listed above are hierarchical. The purpose of this hierarchy is to encode within the plot identifier the relationship between the area being sampled (installation, stand) and the samples collected (plot, subplot). Subplots occur within a plot, plots occur within a stand, and stands occur within an installation. The values for these numeric fields are user-defined and assigned by the contributing organization's database manager. For example, a University of Montana plot coded as source 1, installation 478, stand 2, plot 1 would result in the key 01047802000100 (source = 01, installation = 0478, stand = 02, plot = 0001, subplot = 00).

Depending on the record type, information is recorded at either the stand level or plot level. Information that does not change from plot to plot within a stand, for example treatment history, is recorded only once at the stand level. By not duplicating stand level information for each plot and subplot within the stand, the potential for

error is greatly reduced and the database is easier to maintain. Stand level information is differentiated from plot level information by setting the plot and subplot fields to zero. When retrieving information for a specific plot or subplot, specifying the corresponding installation and stand code will retrieve all of the associated stand level information. Each record type, as it is discussed, will be identified as either stand level or plot level.

Two examples follow to illustrate how the plot identification fields are coded.

Example One—Installation 478 contains two stands (fig. 1). Each stand is approximately 3 acres in size. The treatment applied to stand 1 resulted in a 10-foot spacing, and the treatment applied to stand 2 resulted in a 20-foot spacing. Three sample plots were randomly placed within each stand. The plots are one-fifth acre in size, with a 1/300-acre subplot, and coded as:

Source	Installation	Stand	Plot	Subplot		
1	478	1	1	0	–	Stand 1, 1/5-acre plot
1	478	1	1	1	–	Stand 1, 1/300-acre subplot
1	478	1	2	0	–	Stand 1, 1/5-acre plot
1	478	1	2	1	–	Stand 1, 1/300-acre subplot
1	478	1	3	0	–	Stand 1, 1/5-acre plot
1	478	1	3	1	–	Stand 1, 1/300-acre subplot
1	478	2	1	0	–	Stand 2, 1/5-acre plot
1	478	2	1	1	–	Stand 2, 1/300-acre subplot
1	478	2	2	0	–	Stand 2, 1/5-acre plot
1	478	2	2	1	–	Stand 2, 1/300-acre subplot
1	478	2	3	0	–	Stand 2, 1/5-acre plot
1	478	2	3	1	–	Stand 2, 1/300-acre subplot

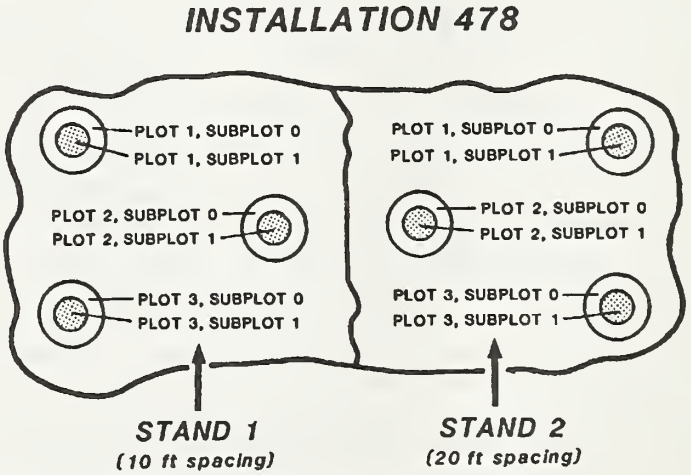

Figure 1—Stand and plot layout for sample installation number 478.

Example Two—Installation 520 contains eight stands (fig. 2). Each stand is slightly larger than one-fifth acre in size. Each stand contains one plot, one-fifth acre in size, and a 66-foot plot buffer. Each stand received one of four possible treatments (no treatment, 10-, 15-, or 20-foot spacing). These plots would be coded as:

Source	Installation	Stand	Plot	Subplot		
1	520	1	1	0	–	Stand 1, 1/5-acre plot
1	520	2	1	0	–	Stand 2, 1/5-acre plot
1	520	3	1	0	–	Stand 3, 1/5-acre plot
1	520	4	1	0	–	Stand 4, 1/5-acre plot
1	520	5	1	0	–	Stand 5, 1/5-acre plot
1	520	6	1	0	–	Stand 6, 1/5-acre plot
1	520	7	1	0	–	Stand 7, 1/5-acre plot
1	520	8	1	0	–	Stand 8, 1/5-acre plot

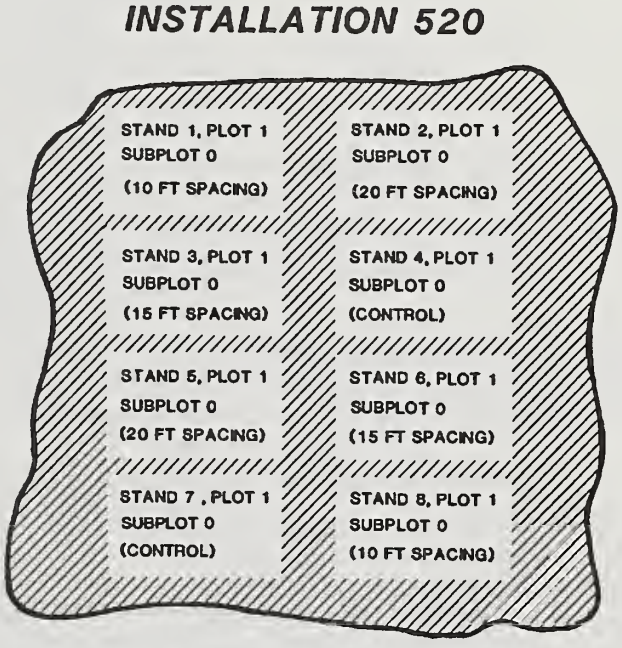

Figure 2—Stand and plot layout for sample installation number 520.

Basic Record Types

Each record type identifies a logical grouping of data fields. The first digit of the three-digit record type number signifies a generalized category of information. The following scheme was used to assign record type numbers:

100's = sampling design
200's = administrative and geographic location
300's = plot descriptors
400's = measurement history
500's = treatment history
600's = site and climate
700's = other
800's = individual tree
900's = comments

When developing new record types, it is advantageous to assign record type identifiers according to the scheme outlined above.

CORE INFORMATION

The core records document sampling design, administrative descriptors, geographic location, plot descriptors, plot summary descriptors, measurement dates, treatment, and site descriptors. This basic information is necessary to fully describe the characteristics of a growth and yield plot independent of tree-level data. The core records are not only useful for analytical reasons, but allow for global searches of a permanent-plot database without having to access individual tree information. Table 1 provides an overview of the core records. Each record is discussed in detail on the following pages.

Table 1—Summary of the core records

Record	Record label	Description
110	Sampling design	Subpopulation characteristics, sampling rule, expansion factor, number of samples, unit of measure. One or more records for each stand.
210	Administrative descriptors	Project name, installation name, administrative organization, owner. One record for each stand.
220	Location descriptors	State, latitude, longitude, UTM coordinates, legal description. One record for each stand.
310	Plot descriptors	Status, stand origin, timber type, site index, age, buffers, sampling design. One record for each plot.
320	Plot summary	Trees per unit area, mean diameter, basal area per unit area, and top height by species and measurement number. One record for each species recorded, each time the plot was measured. An additional record is completed to represent the plot total.
410	Measurement dates	Date for each measurement. One record for each year (a growing season) the plot was measured.
510	Treatment	Date and type of treatment. One record for each treatment the stand received.
610	Site descriptors	Elevation, aspect, slope, topographic position, and bioclimatic zone. One record for each plot.

110. Sampling Design

The sampling design record documents (1) the criteria used to select the sample, and (2) the multiplier to be used when expanding tree data to a per-unit-area basis (expansion factor) for each stand within an installation. The fields for describing sampling design were developed by Byrne and Stage (1988) and were modified to be consistent in structure with other record types. Byrne and Stage thoroughly discuss and provide many examples of implementing the sampling design record.

There are two key reasons why stand, rather than plot or subplot, was chosen as the lowest common denominator when describing sampling design. First, by definition a stand is an area of ground with relatively uniform conditions and a unique treatment combination. It is this combination of uniformity and uniqueness that is being sampled through the use of plots. The effectiveness of sampling is diminished in stands with widely varying plot designs. Therefore, the usual case is to have one sampling design applied to all plots within the stand. Secondly, the integrity of the sampling design information is maintained by not duplicating this information for each plot within a stand.

The sampling design record has two logical groups of fields in addition to the plot identification fields. The first group of fields describes the subpopulation being sampled. This description consists of an identifier (subpopulation number) and several attributes that characterize the subpopulation. The second group of fields describes the sampling rule being applied to the subpopulation. These consist of an identifier (sampling rule number), the variable defining the probability used, the expansion factor, the number of samples, and the unit of measure used.

The subpopulation and sampling rule identifiers, in combination, uniquely identify the sampling design used. One record is completed for each unique sampling design within a stand. In most cases only one record is needed, but it is possible for a stand to have more than one sampling design. Multiple sampling design records may be the result of a sampling approach that varies slightly for a portion of the plots within a stand, or because the design has changed over time as a response to changing informational needs.

The sampling design information is essential for properly calculating summary attributes such as trees per acre and basal area. Because sampling design is recorded at the stand level, the design associated with a particular plot or subplot within the stand needs to be referenced. To do this, the appropriate subpopulation number and sampling rule number are recorded on the plot descriptors record (record type 310).

Field name	Format	Description
Source	N2	
Installation	N4	
Stand	N2	
Plot	N4	Always zero.
Subplot	N2	Always zero.
Record type	N3	110.
Subpopulation number	N1	A sequential number. Within a stand, this number uniquely codes the subpopulation being described.
First subpopulation characteristic	C1	The first characteristic used to define the subpopulation being sampled. D = according to some d.b.h. limit. H = according to some tree height limit. T = according to a tree class code. (Alive, dead, etc.). C = according to a tree condition code. (Insects, disease, etc.). S = according to a species code.
Minimum limit for first subpopulation characteristic	C5	Minimum value or the first nominal code for the first subpopulation characteristic. For continuous variables (D and H above), record the minimum value (format is N5.1). For nominal variables (T, C, and S above), record the code or value used.
Maximum limit for first subpopulation	C5	Maximum value or a second nominal code for the first subpopulation characteristic. For continuous variables (D and H above), record the maximum value (format is N5.1). For nominal variables (T, C, and S above), record the code or value used.
Second subpopulation characteristic	C1	The second characteristic used to define the subpopulation being sampled. As above, record D, H, T, C, or S.
Minimum limit for second subpopulation characteristic	C5	Minimum value or the first nominal code for the second subpopulation characteristic. For continuous variables (D and H above), record the minimum value (format is N5.1). For nominal variables (T, C, and S above), record the code or value used.
Maximum limit for second subpopulation characteristic	C5	Maximum value or a second nominal code for the second subpopulation characteristic. For continuous variables (D and H above), record the maximum value (format is N5.1). For nominal variables (T, C, and S above), record the code or value used.

Sampling rule number	N1	A sequential number. Within this stand, this number uniquely codes the sampling rule used.
Variable defining the probability	C3	The variable that determines the probability by which trees will be selected. FRQ = frequency, for fixed-area plots or linear (strip) plots. BAF = basal area, for a horizontal point sample. DBH = diameter at breast height, for a horizontal line sample. HSQ = square of height, for a vertical point sample. HTS = height, for a vertical line sample.
Expansion factor	N9.4	The expansion factor, corresponding to the sampling rule above, is used to convert tree data to a per-unit-area basis (acres or hectares). For FRQ, the expansion factor is the inverse of the plot or strip area (1/plot area). For BAF, the expansion factor equals the basal area factor (BAF). For DBH, the expansion factor equals the horizontal line factor (HLF). For HSQ, the expansion factor equals the vertical point factor (VPF). For HTS, the expansion factor equals the vertical line factor (VLF).
Total number of samples	N2	Total number of plots used to sample this subpopulation. Record the total number of plots (inclusive) within the stand having a similar sampling design.
Unit of measure	C1	M = metric, E = English. All fields, on all records for this stand, must use the same unit of measure (all English or all metric).

Two examples, both corresponding to figures 1 and 2, illustrate how the sampling design fields are to be completed.

Example One—Installation number 478 contains two stands (fig. 1 illustrates plot configuration). Each stand is approximately 3 acres in size. The treatment applied to Stand 1 resulted in a 10-foot spacing, and the treatment applied to Stand 2 resulted in a 20-foot spacing. Three sample plots were randomly placed within each stand. Each plot is one-fifth acre in size, and contains a 1/300-acre subplot. Within the one-fifth acre plot, all trees greater than or equal to 1.5 inches d.b.h. were measured. Within the 1/300-acre plot, all trees less than or equal to 1.4 inches d.b.h. were measured.

Stand	Plot	Sub-plot	Sub-pop	1st char.	Min.	Max.	Rule	Var. def. probability	Expan. factor	Samples	Unit of measure
1	0	0	1	D	1.5	99.9	1	FRQ	5.0	3	E
1	0	0	2	D	0.1	1.4	2	FRQ	300.0	3	E
2	0	0	1	D	1.5	99.9	1	FRQ	5.0	3	E
2	0	0	2	D	0.1	1.4	2	FRQ	300.0	3	E

Example Two—Installation 520 contains eight stands (fig. 2 illustrates plot configuration). Each stand is slightly larger than one-fifth acre in size. Each stand contains one plot, one-fifth acre in size, and a 66-foot plot buffer. Each stand received one of four possible treatments (no treatment, 10-, 15-, or 20-foot spacing). Within each plot all trees greater than 0.6 inches d.b.h. were measured.

Stand	Plot	Sub-plot	Sub-pop	1st char.	Min.	Max.	Rule	Var. def. probability	Expan. factor	Samples	Unit of measure
1	0	0	1	D	0.6	99.9	1	FRQ	5.0	1	E
2	0	0	1	D	0.6	99.9	1	FRQ	5.0	1	E
3	0	0	1	D	0.6	99.9	1	FRQ	5.0	1	E
4	0	0	1	D	0.6	99.9	1	FRQ	5.0	1	E
5	0	0	1	D	0.6	99.9	1	FRQ	5.0	1	E
6	0	0	1	D	0.6	99.9	1	FRQ	5.0	1	E
7	0	0	1	D	0.6	99.9	1	FRQ	5.0	1	E
8	0	0	1	D	0.6	99.9	1	FRQ	5.0	1	E

If the design changed in a subsequent measurement to include only trees greater than 3.0 inches d.b.h., an additional record for each stand listed above would be completed as follows:

Stand	Plot	Sub-plot	Sub-pop	1st char.	Min.	Max.	Rule	Var. def. probability	Expan. factor	Samples	Unit of measure
1	0	0	2	D	3.0	99.9	1	FRQ	5.0	1	E
2	0	0	2	D	3.0	99.9	1	FRQ	5.0	1	E
3	0	0	2	D	3.0	99.9	1	FRQ	5.0	1	E
4	0	0	2	D	3.0	99.9	1	FRQ	5.0	1	E
5	0	0	2	D	3.0	99.9	1	FRQ	5.0	1	E
6	0	0	2	D	3.0	99.9	1	FRQ	5.0	1	E
7	0	0	2	D	3.0	99.9	1	FRQ	5.0	1	E
8	0	0	2	D	3.0	99.9	1	FRQ	5.0	1	E

Note that only the subpopulation definition changed (minimum d.b.h. from 0.6 inches to 3.0 inches); the sampling rule remained the same (one 1/5-acre plot). Fields in the plot descriptors record (record type 310) will also have to be updated to reflect the change in sampling design.

210. Administrative Descriptors

The administrative descriptors record provides a means to identify stands by project name, installation name, administrative organization, or land ownership. Two user-defined fields document project name and installation name. Because these fields are used to retrieve all information for stands or plots installed under a specific project or installation name, it is important to be consistent when completing these fields. Two additional fields code the data administrator and owner. One record is completed for each stand.

Field name	Format	Description
Source	N2	
Installation	N4	
Stand	N2	
Plot	N4	Always zero.
Subplot	N2	Always zero.
Record type	N3	210.
Project name	C25	Defined by the organization. Project names need to be consistent when they apply to more than one stand. This name is used to retrieve information for all plots installed under the same project.
Stand name	C25	Defined by the organization. The stand name can be a number and/or common name used by the organization for stand identification.
Stand administrator	C3	The organization responsible for the maintenance of the stand. Use the organization codes listed below.
Stand owner	C3	The landowner for the stand. Use the organization codes listed below. Additional codes may be added for organizations not listed here.

Organization codes:

- BCE – Boise Cascade, eastern Washington region
- BIA – Bureau of Indian Affairs (Portland)
- BLM – Bureau of Land Management
- CIT – Champion International, Timberlands
- COT – Colville Tribe
- FHT – Flathead Tribe
- FS1 – USDA Forest Service, Region 1
- IDL – Idaho Department of Lands
- IEP – Inland Empire Paper Company
- IBS – Intermountain Research Station (Boise)
- IBZ – Intermountain Research Station (Bozeman)
- IMO – Intermountain Research Station (Moscow)
- IMI – Intermountain Research Station (Missoula)
- MOF – British Columbia Ministry of Forests
- MSL – Montana Department of State Lands
- NPT – Nez Perce Tribe
- PBT – Port Blakely Tree Farms
- POT – Potlatch Corporation
- PVT – Private (small private)
- TNC – Tree Nutrition Cooperative (University of Idaho)
- UAL – University of Alberta
- UBC – University of British Columbia
- UID – University of Idaho
- UMT – University of Montana
- UWA – University of Washington
- WNR – Washington Department of Natural Resources
- WSU – Washington State University

220. Location Descriptors

The location descriptors record documents the geographic location of a stand. Latitude/longitude or Universal Transverse Mercator (UTM) coordinates entered within this record would allow the user adequate resolution to determine stand distribution within an installation or region. The coordinate fields are sufficient in size to capture information from a geographic information system or global positioning system. In a collective database, information could by retrieved by legal description, State, or geographic coordinates. One record is completed for each stand. Record the location of the center of the stand instead of an edge. If coordinates are available at the plot level, this record-type can easily be used for individual plot locations in addition to stand-level location. Additional records may have to be defined for documenting traverse information needed to locate plots on the ground.

Field name	Format	Description
Source	N2	
Installation	N4	
Stand	N2	
Plot	N4	Always zero.
Subplot	N2	Always zero.
Record type	N3	220.
State/Province	C2	Postal Service State or Province codes (MT = Montana)
Latitude (degrees)	N3	Record degrees of latitude.
Latitude (minutes)	N2	Record minutes of latitude.
Latitude (seconds)	N5.2	Record seconds of latitude. Sufficient space is allocated to record seconds of latitude to the nearest 100th of a second.
Longitude (degrees)	N3	Record degrees of longitude.
Longitude (minutes)	N2	Record minutes of longitude.
Longitude (seconds)	N5.2	Record seconds of longitude. Sufficient space is allocated to record seconds of longitude to the nearest 100th of a second.
UTM zone	N2	Record the UTM zone.
UTM easting	N6	Record the easting in meters for the southwest corner of the UTM grid cell encompassing the stand.
UTM northing	N7	Record the northing in meters for the southwest corner of the UTM grid cell encompassing the stand.
Grid type code	N1	The grid-type code references the format to be used when reading the grid-type description (below). Record the appropriate code from the list below. No grid-types have been defined for Canada but may be added and defined as needed. 1 = United States Township Grid.
Grid-type description	C20	This field contains all of the fields that define the information needed to describe a particular grid type. The appropriate format to use for this field is designated by the grid-type code. The format for each coordinate system is described below, and is coincident with this 20-character field.

GRID TYPE DESCRIPTIONS

Grid type 1—The following fields provide a legal description for stands in most areas of the United States. These fields collectively replace the 20-character grid type description field described above.

Field name	Format	Description
Nearest forty	C4	Nearest 40-acre partition of standard 640-acre section in which the stand occurs (NENW).
Section number	C2	Two-digit section number from 01 to 36.
Range	C3	Record range number, and "E" (east) or "W" (west).
Half-range	C1	Included to accommodate some localities in Washington. Y = yes, N = no.
Township	C3	Record township number, and "N" (north) or "S" (south).
Half-township	C1	Included to accommodate some localities in Washington. Y = yes, N = no.
Base meridian	C2	Enter code for base meridian. WM = Willamette meridian (Oregon and Washington) PR = Principal meridian (Montana) BO = Boise meridian (Idaho).
Blank	C4	The remaining four columns are left blank.

310. Plot Descriptors

A basic description of plot characteristics is provided using the plot descriptors record. This record describes the current status of the plot, the units of measurement, stand origin, timber type, age, site index, the presence of buffers, and the sampling design used. Although most of the information in this record is static, it is important that it contain the most current information. A more detailed description of the population is obtained from the plot level species summary (plot summary descriptors, record type 320). One record is completed for each plot.

Within this record, timber type is defined by the combined species codes (appendix A) for the primary and secondary species. Determination of the primary and secondary species is based on the percentage of total basal area represented by the various species occupying the plot. Appendix B defines the procedure for determining the primary and secondary species.

Field name	Format	Description
Source	N2	
Installation	N4	
Stand	N2	
Plot	N4	
Subplot	N2	
Record type	N3	310.
Plot status	C1	Indicates the availability of this plot for future remeasurement, or for the collection of additional data. Record plot status for damaged plots and note the nature of the damage using comments (record type 900). A = Actively maintained, and scheduled for remeasurement. I = Inactive, but available for remeasurement (discontinued). X = Destroyed, data only available for prior measurement periods (irrecoverable).

Comment flag	C1	Calls attention to comments of possible concern to subsequent use of this plot for analysis (Y = yes, N = no). If a Y is entered in this field, the user should assume further information is available in the comment records (record type 900).
Treatment code	C4	A user-defined code indicating which stands within this installation were treated similarly. This code is useful for extracting plots that were similarly treated.
Stand origin	C1	N = natural establishment. S = artificially seeded. P = planted. G = genetically improved planted stock. F = planted with major natural fill-in. (User-defined, a suggested minimum is 25 percent by number of stems). O = other (for example, coppice).
Primary species	C2	Enter the primary species code (appendix A). See appendix B for the determination of primary species.
Secondary species	C2	Enter the secondary species code (appendix A). See appendix B for the determination of secondary species.

All ages are based on the age of the mean top-height component of the plot. Ideally, these ages are calculated from the tree data. The Society of American Foresters (1983) defines mean top-height as "the mean height of a predetermined number of the thickest stems."

Breast-height age of the primary species	N3	Average age at breast-height for the top-height component (40 largest diameter trees/acre, or 100/hectare) of the primary species.
Breast-height age of the secondary species	N3	Average age at breast-height for the top-height component (40 largest diameter trees/acre, or 100 /hectare) of the secondary species.
Total age of the primary species	N3	Average total age for the top-height component (40 largest diameter trees/acre, or 100/hectare) of the primary species.
Total age of the secondary species	N3	Average total age for the top-height component (40 largest diameter trees/acre, or 100/hectare) of the secondary species.
First site index species	C2	Specify the first species code (appendix A) used to reference site index.
Site index for first site species	N3	Average site index for the first site index species.
Reference code for first site index species	C4	See appendix C for reference codes. This code documents the author, year of publication, base age, and region for each available site index curve or equation.

Site index methodology for first site index	N1	Use the methodology codes listed below. These methodology codes document the method used to obtain mean site index for the first site index species. 0 = method unknown. 1 = calculated from site trees in the tree data file. 2 = calculated from site trees, source not defined. 3 = estimated from top-height component. 4 = estimated from overall tree height/age relationship. 5 = estimate based on the professional judgment of the recorder. 6 = estimated from the midpoint of site classes. 7 = estimate based on habitat type or bioclimatic zone.
Second site index species	C2	Specify the second species code (appendix A) used to reference site index.
Site index for second site index species	N3	Average site index for the second site index species.
Reference code for second site index species	C4	See appendix C for reference codes. This code documents the author, year of publication, base age, and region for each available site index curve or equation.
Site index methodology for second site index species	N1	Use the methodology codes listed above to document the method used to obtain mean site index for the second site index species.
Plot buffer	C1	Buffer of similar condition and treatment around plot (Y = yes, N = no).
Average width of buffer	N5.1	Record the average width of the buffer in feet, or meters and tenths.

The following fields allow for documenting the sampling design used when the plot was installed, and one change in design during subsequent remeasurements. Additional changes in design can be appended to the end of this record.

Subpopulation/ sampling rule combination used at installation	N2	Record the subpopulation/sampling-rule combination from the sampling design record (record type 110) that corresponds to the subpopulation characteristics and sampling rule used when this plot was installed. Record as subpopulation number (N1) followed by the associated sampling rule number (N1).
Measurement number	N2	Record the measurement number (see record type 410) for the year this subpopulation/sampling rule combination was first used (year plot was installed).
First change in the initial sampling design	N2	Record the subpopulation-sampling rule combination from the sampling design record (record type 110) corresponding to the subpopulation characteristics and sampling rule used when the sampling design changed. Record as subpopulation number (N1) followed by the associated sampling rule number (N1).
Measurement number for first change in sampling design	N2	Record the measurement number (see record type 410) for the year this subpopulation/sampling rule combination was first used (year sampling design changed).

320. Plot Summary Descriptors

The plot summary descriptors record provides a per-unit-area (acres or hectares) summary of tree data recorded at the plot and species level. Sufficient information is provided to calculate estimates of relative density (Curtis 1982), stand density index (Reineke 1933), or crown competition factor (Krajicek 1961). The values for the fields in this record can be calculated from the individual tree measurements record (record type 820). Note that these calculated values are based on the subpopulation of trees sampled. One record is completed for each time the plot is measured. In addition, one record per plot per measurement is completed for each species.

Field name	Format	Description
Source	N2	
Installation	N4	
Stand	N2	
Plot	N4	
Subplot	N2	
Record type	N3	320.
Measurement number	N2	Corresponding measurement number from measurement dates record (record type 410).
Species code	C2	For a plot summary, set species code equal to 99. For a species summary, record the species code (appendix A).
Number of trees per unit area	N6	Number of trees per unit area (trees/acre or trees/ha) for this measurement.
Quadratic mean diameter	N4.1	Diameter of the tree of mean basal area, recorded to the nearest tenth of an inch (or centimeter).
Total basal area per unit area	N5.1	Total basal area per unit area (ft^2/acre or m^2/ha), to the nearest tenth of a square unit.
Top height	N5.1	The average height of the 40 largest diameter trees per acre or 100 trees per hectare, recorded to the nearest tenth of a foot (or meter).

410. Measurement Dates

The following fields document the initial and remeasurement dates for each plot, regardless of treatment. Zeros are recorded where information is not available. For analyses, the measurement interval can be calculated from these dates. It is critical that the measurement number field on other records is consistent with the corresponding measurement number information (year, month, and day) on this record. One record is completed for each year (growing season) the plot was measured.

Field name	Format	Description
Source	N2	
Installation	N4	
Stand	N2	
Plot	N4	
Subplot	N2	
Record type	N3	410.
Measurement number	N2	The sequential measurement number for this plot. The initial measurement is 1.
Measurement year	N4	Must be completed for each year the plot has been measured.
Measurement month	N2	If unknown, record a zero.
Measurement day	N2	If unknown, record a zero.

510. Treatment Descriptors

The treatment descriptors record is designed to provide a basic description of stand treatment. The term "treatment" is applied in the experimental sense to include both treated and untreated stands. A plot is still considered "treated" even if no alteration of the stand takes place (control plot). The user may choose to define additional record types to document the details of each treatment.

The proper way to document stands serving as an experimental control needs to be clearly understood. While compiling information for a large number of permanent growth and yield plots it became apparent that controls could be grouped into two categories. The first category of control stands occurred in unaltered, natural forests. The second category of control stands occurred in natural forest stands that were thinned or altered prior to establishing the study. Alteration of a forest stand was usually done to prepare a site for the application of a designed experimental treatment, such as fertilization, in which a group of unfertilized (but thinned) stands served as a control. Both categories of control stands would be traditionally coded as "untreated," but for the latter category, a user would be unaware that the stand had been altered prior to installation of the study. To distinguish between these two categories, an additional field was created to indicate whether the control treatment was being placed in a stand that had been intentionally altered prior to plot installation. By not making this distinction, a bias could be introduced when interpreting the growth response of trees from controls placed in natural stands versus altered stands.

One record is completed for each treatment the stand received. The initial treatment is treatment number one. It is possible to document treatments imposed on the stand prior to plot establishment by using *non-zero* negative numbers for treatment number.

Field name	Format	Description
Source	N2	
Installation	N4	
Stand	N2	
Plot	N4	Always zero.
Subplot	N2	Always zero.
Record type	N3	510.
Treatment number	N2	Sequential treatment number for this stand. Initial treatment number is 1. Treatments prior to plot establishment are numbered sequentially beginning with –1.
Year of treatment	N4	Must be completed for each treatment. For control stands this would be the installation year.
Month of treatment	N2	If unknown, enter zero.
Day of treatment	N2	If unknown, enter zero.
Prior stand alteration	C1	Record Y if the stand was intentionally altered prior to the establishment of the study, otherwise enter N.

Treatment class	C1	General type of treatment. Enter the most appropriate code. U = Untreated (control or natural stand). R = Regeneration system. T = Thinning or spacing control. F = Fertilization. S = Site preparation. B = Brush control. O = Other (describe in record type 900).
Treatment type	C2	The category of codes to choose from below must correspond to the treatment class code used above. Enter the most appropriate code, or leave blank if treatment class is "Other." If untreated or control (U above) UT = Untreated If regeneration system (R above) CC = Clearcut ST = Seed tree SW = Shelterwood SL = Selection (group or individual) If thinning or spacing control (T above) MH = Mechanical (hand or chainsaw) MD = Mechanical (dozer or feller-buncher) CH = Chemical If fertilization (F above) AA = Aerial application HA = Hand application If brush control (B above) CA = Chemical (aerial application) CH = Chemical (hand application) MC = Mechanical BU = Burning

610. Site Descriptors

The following fields describe general site characteristics for the plot. Fields are provided for soil site index, which is used by some agencies as an indirect estimate of a species site index when suitable site trees are not available in the stand. One record is completed for each plot.

Field name	Format	Description
Source	N2	
Installation	N4	
Stand	N2	
Plot	N4	
Subplot	N2	
Record type	N3	610.
Elevation	N5	Record in feet or meters.
Aspect	N3	Record aspect in degrees azimuth except for the following special cases. North = 360 Flat terrain = 999 Missing value = 0
Slope	N3	Record percent slope (10 for 10 percent slope) except for the following special cases. Flat terrain = 999 Missing value = 0
Position	N1	Position codes identify the relative topographic position of the plot. These codes should relate to most other coding systems in use. 1 = Flat or rounded ridge or hilltop 2 = Narrow ridge or hilltop 3 = Sidehill - upper one-third 4 = Sidehill - middle one-third 5 = Sidehill - lower one-third 6 = Draw bottom 7 = Bench or terrace (surface or ground water influenced) 8 = Broad flat, basin, or gentle terrain.
Soil site index species code	C2	Record the reference species code (appendix A) for the soil site index.
Soil site index	N3	Site index value estimated from soil, climate, and topography.
Soil site index reference code	C4	User-defined author reference code for soil site index. This code, and the appropriate reference, should be added to appendix C.

Bioclimatic zone	C30	The classification descriptor for the classification system used. Left-justify the descriptor in the field. For the States of Washington and Oregon, use the eco-class coding system and record the alphanumeric life-form and the two-digit numeric association (for example, record CWG1-12 for: the conifer climax community, white fir major climax species, pinegrass ground vegetation, and the association [12] of ABGR/CARU-ASH). For other States in the Inland Northwest, use habitat mnemonics, recorded as Series/Type-Phase (for example, PSME/PHMA-PHMA or PSME/PHMA). For British Columbia, use the biogeoclimatic classification system and record the appropriate zone/site code (for example, SBSe2/01 for the Sub-Boreal Spruce Zone [SBS], Moist Cool Central Subzone [e], Fraser Basin Variant [2], Bunchberry-Moss Site Series [01]).
Classification system	C7	This code documents the classification system used. The first five letters document the author, and the last two characters document the year the classification was published. (Example: PFIST77, for Pfister, Montana, 1977, "Habitat Types of Montana.") DAUBE68 = Daubenmire and Daubenmire (1968) FRANK73 = Franklin and Dyrness (1973) PFIST77 = Pfister and others (1977) COOPE87 = Cooper and others (1987) STEEL81 = Steele and others (1981) STEEL83 = Steele and others (1983) HALL 84 = Hall (1984) POJAR87 = Pojar and others (1987)

SUPPLEMENTAL INFORMATION

Supplemental records are special-purpose records that expand on information provided by the core records. Supplemental records are developed as required to meet the objectives of information exchange or plot documentation. During the development of a standardized database for the Inland Northwest Growth and Yield Cooperative, additional records were defined to document administrative units, fertilization treatments, soils, climate, and regression coefficients for height from d.b.h. regressions. Table 2 provides an overview of the currently defined supplemental records. Each record is discussed in detail on the following pages.

Table 2—Summary of the supplemental information records

Record type	Record label	Description
230	Administrative units	Forest, district, compartment, timber unit or other user-defined information. One record for each stand or plot.
520	Fertilization treatments	Nutrient source, application rate of nitrogen, phosphorus, potassium, sulfur, or micronutrient. One record for each time the stand was fertilized.
620	Soil descriptors	Soil profile description availability, physical or chemical analyses, rooting depth, texture of soil to rooting depth, coarse fragments, and drainage class. One record for each stand.
630	Climatic descriptors	Annual precipitation, growing season precipitation, mean growing season temperature, degree days, frost-free days. One record for each stand.
710	Height from d.b.h. regression	Measurement number, species code, and a description of the equation form, including coefficients. One record for each d.b.h./height regression.

230. Administrative Units

As discussed earlier, the source, installation, stand, plot, and subplot fields are used to internally reference plots across the various records described in this report. It is typical for each organization to have additional fields that provide a more familiar or descriptive identifier than the internal identifier used here. The administrative units record type was designed to provide a link between the identifier used in this report and an organization's own recordkeeping system. Suggested field descriptions are provided, but the full record, after the record-type field and up to column 80, is available to the user for defining fields applicable to their needs. One record per stand or plot.

Field name	Format	Description
Source	N2	
Installation	N4	
Stand	N2	
Plot	N4	
Subplot	N2	
Record type	N3	230.
Forest (Farm)	C5	Forest or tree farm license code used by the organization.
District	C5	District or block code used by the organization.
Compartment	C5	Compartment code used by the organization.
Timber unit (stand)	C5	Timber unit or stand code used by the organization.
Additional information	C43	Additional cross-referencing information.

520. Fertilization Treatments

The fertilization treatments record is designed to provide a very basic description of fertilization treatments. A user may have to define additional fields or records to document the details of the fertilization treatment. One record for each time the stand was fertilized.

Field name	Format	Description
Source	N2	
Installation	N4	
Stand	N2	
Plot	N4	Always zero.
Subplot	N2	Always zero.
Record type	N3	520.
Treatment number	N2	Record the corresponding treatment number from the treatment descriptors record (record type 510).
Source of nutrient	C35	Record the compound used for fertilization. User-defined.
Application rate of nitrogen	N3	Lb/acre (kg/ha) of nitrogen applied to the stand.
Application rate of phosphorus	N3	Lb/acre (kg/ha) of phosphorus applied to the stand.
Application rate of potassium	N3	Lb/acre (kg/ha) of potassium applied to the stand.
Application rate of sulfur	N3	Lb/acre (kg/ha) of sulfur applied to the stand.
Application rate of micronutrient	N3	Lb/acre (kg/ha) of micronutrient applied to the stand.

620. Soil Descriptors

The following fields provide a cursory description of information available on soils for a particular stand. One record for each stand.

Field name	Format	Description
Source	N2	
Installation	N4	
Stand	N2	
Plot	N4	Always zero.
Subplot	N2	Always zero.
Record type	N3	620.
Soil profile description available	C1	Documents the availability of a soil description for this stand from the organization. Y = yes, N = no.
Physical soil description available	C1	Documents the availability of a description of the physical characteristics of the soil for this stand from the organization. Y = yes, N = no.
Chemical soil description available	C1	Documents the availability of a description of any chemical analysis done for the soil on this stand from the organization. Y = yes, N = no.
Rooting depth	N4.1	Depth to which the bulk of fibrous roots penetrate. Record the depth where the USDA Soil Conservation Service (1975) abundance class drops from common to few for fine and medium roots.

Texture of soil to rooting depth	C4	Texture class code from the list below: SAND = sand LOSA = loamy sand SALO = sandy loam LOAM = loam SACL = sandy clay loam CLLO = clay loam SANC = sandy clay CLAY = clay SILC = silty clay SICL = silty clay loam SILO = silty loam SILT = silt FMAT = fibric material HMAT = hemic material PEAT = peat CIND = cinders VASH = andic, volcanic ash
Coarse fragments	N2	Percentage, by volume, of coarse fragments greater than 2 mm in the rooting zone.
Drainage class	N1	The drainage class codes document infiltration rates for soils. 1 = poor, 1 cm/h 2 = moderate, 5 cm/h 3 = well, 10 cm/h

630. Climatic Descriptors

The following fields generally describe the local climate. The source and accuracy of this information is not defined or documented. One record per stand.

Field name	Format	Description
Source	N2	
Installation	N4	
Stand	N2	
Plot	N4	Always zero.
Subplot	N2	Always zero.
Record type	N3	630.
Annual precipitation	N3	Total annual precipitation.
Growing season precipitation	N3	Total precipitation for the growing season.
Mean growing season temperature	N3	Average temperature for the growing season.
Degree days	N5	The cumulative degree days above which growth of a species can be initiated and maintained.
Frost-free days	N3	Average number of consecutive frost-free days per year (frost-free season).

710. Height From D.b.h. Regression

The height from d.b.h. regression coefficients are calculated from the tree data file. This record provides a means to capture those coefficients and the appropriate equation form. One record for each d.b.h./height regression.

Field name	Format	Description
Source	N2	
Installation	N4	
Stand	N2	
Plot	N4	
Subplot	N2	
Record type	N3	710.
Measurement number	N2	Corresponding measurement number from record type 410 (Measurement dates). If the equation is developed from data pooled across remeasurements, record 0.
Species code	C2	See appendix A for species code.
Continuation number	N1	This code allows for continuing longer equation records. First record is 1; additional records are numbered sequentially.
Equation form	C55	Document equation, including coefficients, using ANSI (1978) FORTRAN-77 standard functions. For example: –2.113 + (6.288*DBH) – (0.090*(DBH**2)) is recorded for the equation: total height = –2.113 + 6.288 d.b.h. – 0.090 d.b.h.^{2}.

INDIVIDUAL TREE INFORMATION

Individual tree measurements and history are the essential core of long-term growth and yield plots. Individual tree measurements are the source of summary information detailed in other records. Proper data interpretation and management dictates the necessity for individual tree records to be as complete and accurate as is reasonable, given the resources available within an organization.

Table 3 provides an overview of the currently defined individual tree records. The fields identified are those that are commonly recorded. Organizations are encouraged to expand on this basic structure and add the fields necessary to fully document and describe the tree measurements recorded. For example, the University of Montana developed a height measurement record, based on Curtis' (1983) procedures, to carry the detail for height measurements, such as clinometer angles, slope distance, and pole length. Each record is discussed in detail on the following pages.

Table 3—Summary of the individual tree records

Record type	Record label	Description
810	Individual tree descriptors	Tree number, species, age, stem-map coordinates, number of replicates, and number of measurements. One record for each tree measured.
820	Individual tree measurements	Tree number, measurement number, diameter, height, live crown, measurement precision, crown class, tree status, tree class, damage, and radial growth. One record for each year an individual tree was measured.

810. Individual Tree Descriptors

The individual tree descriptors record describes tree attributes which generally do not change over time. One record is completed for each tree in the plot. The number of measurement fields can be generated and updated from the individual tree measurements records (record-type 820). The primary key (source, installation, stand, plot, subplot) and tree number will uniquely identify data for an individual tree.

Field name	Format	Description
Source	N2	
Installation	N4	
Stand	N2	
Plot	N4	
Subplot	N2	
Record type	N3	810.
Tree number	N4	Number assigned by the organization to an individual tree.
Species code	C2	Record the two-character species code (see appendix A).
Breast-height age	N3	Record breast-height age at the first measurement (initial measurement of the tree).
Total age	N3	Record total age at the first measurement (initial measurement of the tree).
X-coordinate	N7.2	Coordinate position of this tree relative to a user-defined origin. Record X-position in tenths of feet or 100ths of meters from origin.

Y-coordinate	N7.2	Coordinate position of this tree relative to a user-defined origin. Record Y-position in tenths of feet or 100ths of meters from origin.
Bearing from plot center	N3	Record degrees azimuth from plot center to this tree. Record 360 for north. For use when X-Y coordinates are not appropriate, such as for circular plots.
Distance from plot center	N6.2	Record the horizontal distance from plot center to this tree, in tenths of feet or 100ths of meters. For use when X-Y coordinates are not appropriate, such as for circular plots.
Number of replicates	N5	Expansion factor to be used when this tree represents "n" other trees on the plot. For most plots the replicate value will be 1. Record the number of trees per plot represented by this tree number.
Number of measurements	N2	Number of measurement records for this tree. This value corresponds to the total number of measurement records (record type 820) recorded for this tree.

820. Individual Tree Measurements

The following list describes individual tree attributes recorded at each measurement. The primary key (source, installation, stand, plot, subplot), in addition to tree number and measurement number, will uniquely identify a single measurement for any tree. One record is completed for each year an individual tree is measured.

Field name	Format	Description
Source	N2	
Installation	N4	
Stand	N2	
Plot	N4	
Subplot	N2	
Record type	N3	820.
Tree number	N4	Number assigned by the organization to an individual tree.
Measurement number	N2	This number corresponds to the measurement number recorded for this measurement on record type 410.
Diameter at breast height	N5.1	Diameter at breast-height (d.b.h.) in inches or centimeters.
Diameter-measurement precision code	N1	Code the d.b.h. measurement precision. 0 = not directly observed or tree has not reached breast height (or not one of the other codes listed) 1 = ±0.1 inch (D-tape or caliper) 2 = ±1 inch (Biltmore stick) 3 = ±2 inches (ocular estimate to 2-inch class) Codes 4-8 reserved for future use 9 = estimate calculated from previous and subsequent d.b.h. measurements

Total height	N6.2	Total height in feet or meters.
Height-measurement precision code	N1	Code the height-measurement precision. 0 = not directly observed or not one of the other codes listed 1 = ±0.1 feet (transit) 2 = ±0.5 feet (telescoping height pole) 3 = ±1 foot (clinometer, Abney level, Haga altimeter) Codes 4-6 reserved for future use 7 = ocular estimate in the field 8 = estimate calculated from height from d.b.h. regression equation 9 = estimate calculated from previous and subsequent height measurements
Percent live crown	N3	Percentage of total height in live crown in whole units. Use a comment record to document the definition of the base of the live crown.
Live crown precision code	N1	Code the measurement precision for percentage of live crown. 0 = not directly observed 2 = ±1 percent (measured heights with clinometer, etc.) 6 = ±5 percent (ocular estimate)
Crown class	N1	Crown class code. See appendix D.
Tree status	N1	Tree status code. See appendix D.
Tree class	N1	Tree class code. See appendix D.
First tree condition	N2	First tree condition code. See appendix E.
Severity of damage 1	N1	Severity of damage associated with the first tree condition code. See appendix F.
Location of damage 1	N1	Location of damage associated with the first tree condition code. See appendix F.
Second tree condition	N2	Second tree condition code. See appendix E.
Severity of damage 2	N1	Severity of damage associated with the second tree condition code. See appendix F.
Location of damage 2	N1	Location of damage associated with the second tree condition code. See appendix F.
Third tree condition	N2	Third tree condition code. See appendix E.
Severity of damage 3	N1	Severity of damage associated with the third tree condition code. See appendix F.
Location of damage 3	N1	Location of damage associated with the third tree condition code. See appendix F.
Radial-growth increment	N4.2	Radial growth from increment cores recorded for the interval length documented below. For example, a 1-inch radial increase for a 10-year period is recorded as 1.00.
Radial-growth interval	N2	Record the measurement interval (number of years) represented by the radial-growth increment recorded above.

COMMENTS

900. Comment Card

The following fields provide a means for recording any information that would be helpful to the user in interpreting plot information. These fields are useful for documenting the overall purpose, objective, and characteristics of an installation, stand, plot, or subplot.

Field name	Format	Description
Source	N2	
Installation	N4	
Stand	N2	
Plot	N4	
Subplot	N2	
Record type	N3	900.
Continuation number	N2	Numerical sequence of the comment card within an installation, stand, plot, or subplot.
Blank	C1	One column is left blank before comments to improve readability.
Comments	C60	General comments for any installation, stand, plot, or subplot. The comments for each level are "keyed" by using the installation, stand, plot, and subplot codes. For example, to define comments at the installation level record the installation number; and set stand, plot, and subplot to zero.

910. Individual Tree Comment Card

The following fields provide a means for recording any information that would be helpful to the user in interpreting individual tree information. These fields are useful for documenting any unique characteristics about the measurement of a specific tree.

Field name	Format	Description
Source	N2	
Installation	N4	
Stand	N2	
Plot	N4	
Subplot	N2	
Record type	N3	910.
Tree number	N4	
Measurement number	N2	
Continuation number	N2	Numerical sequence of the individual tree comment card for an individual tree.
Blank	C1	One column is left blank before comments to improve readability.
Comments	C50	General comments for an individual tree at a particular measurement.

CONCLUSIONS

The data fields and formats presented here have been tested against a large number of growth and yield plots being maintained by the University of Montana and the Intermountain Research Station's Forestry Sciences Laboratory at Moscow, ID. Given the diversity of growth and yield information, standard definitions and formats provide a means to communicate knowledge while maintaining data integrity. In addition, these definitions and data formats can be extracted and referenced for other types of data processing and data collection, such as forest inventory or formal research projects. Although the data structure presented here is flexible enough to accommodate new types of information, an attempt has been made to identify information basic to interpreting, understanding, and documenting growth and yield plot data. Whether or not these formats are fully adopted by an organization, the formats and definitions provide the building blocks for sound data management.

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APPENDIX A: SPECIES CODES

Standard alpha species codes. The INGY codes are mostly similar to COSMADS codes (Arney and Curtis 1977), with some extensions.

INGY	Common name	Scientific name
DF	Douglas-fir	*Pseudotsuga menziesii*
XH	Hemlock species	*Tsuga* spp.
WH	Western hemlock	*Tsuga heterophylla*
MH	Mountain hemlock	*Tsuga mertensiana*
XS	Spruce species	*Picea* spp.
ES	Engelmann spruce	*Picea engelmannii*
XL	Larch species	*Larix* spp.
AL	Subalpine larch	*Larix lyallii*
WL	Western larch	*Larix occidentalis*
XF	True fir species	*Abies* spp.
AF	Subalpine fir	*Abies lasiocarpa*
GF	Grand fir	*Abies grandis*
NF	Noble fir	*Abies procera*
SF	Pacific silver fir	*Abies amabilis*
XC	Cedar species	*Thuja* spp.
RC	Western redcedar	*Thuja plicata*
XP	Pine species	*Pinus* spp.
LP	Lodgepole pine	*Pinus contorta*
PP	Ponderosa pine	*Pinus ponderosa*
PF	Limber pine	*Pinus flexilis*
PA	Whitebark pine	*Pinus albicaulis*
WP	Western white pine	*Pinus monticola*
JP	Jack pine	*Pinus banksiana*
XJ	Juniper species	*Juniperus* spp.
PY	Pacific yew	*Taxus brevifolia*
PB	Paper birch	*Betula papyrifera*
RA	Red alder	*Alnus rubra*
MM	Mountain maple	*Acer spicatum*
BM	Big leaf maple	*Acer macrophyllum*
QA	Quaking aspen	*Populus tremuloides*
CO	Black cottonwood	*Populus trichocarpa*
BP	Balsam poplar	*Populus balsamifera*
CH	Cherry species	*Prunus* spp.
WI	Willow species	*Salix* spp.
CX	Miscellaneous conifers	
HX	Miscellaneous hardwoods	
XX	Unknown species	

APPENDIX B: DETERMINATION OF PRIMARY AND SECONDARY SPECIES

The following procedure for determining primary and secondary species (Arney and Curtis 1977) is based on plot basal area. This procedure can be adapted to areas with only regeneration by substituting percentage of total number of trees for basal area.

A. If the species with the *greatest* percentage of basal area is 80 to 100 percent of the total plot basal area.

Action: Name this species as the primary species; no secondary species is named.

B. Otherwise, if the species with the *greatest* percentage of basal area is 50 to 79 percent of the total plot basal area.

Action: Name this species as the primary species, and determine the secondary species:

1. If the species with the *second greatest* percentage of basal area is 20 percent or greater then name this species as the secondary species.
2. Otherwise, name the species group as the secondary species (CX for mixed conifers, HX for mixed hardwoods).

C. Otherwise, the species with the *greatest* percentage of basal area is less than 50 percent of the total plot basal area.

Action: Name the species group as the primary species (CX for mixed conifers, HX for mixed hardwoods), and determine the secondary species:

1. If the species with the *greatest* percentage of basal area is 20 percent or greater, then name this species as the secondary species.
2. Otherwise, no secondary species is named.

APPENDIX C: SITE INDEX CODES

Codes for available site index curves and equations. A site index species code is designated with a sequential two-digit number that is based on the date of that reference in relation to other site index references for that species.

Site- index code	Reference	Locality	Index Age
DOUGLAS-FIR:			
DF01	King (1966)	western WA	50
DF02	Brickell (1968)	western MT,ID,WY,UT,CO	50
DF03	Cochran (1979a)	eastern OR, eastern WA	50
DF04	Summerfield (1980a)	eastern WA	50
DF05	Hegyi and others (1981)	BC	50
DF06	Hegyi and others (1981)	BC	100
DF07	Monserud (1985)	northern ID, northwestern MT	50
ENGELMANN SPRUCE:			
ES01	Brickell (1966)	western MT,ID,WY,CO,UT	50
ES02	Alexander (1967)	CO, WY	100
ES03	Clendenen (1977)	CO, WY	50
GRAND FIR:			
GF01	Stage (1959)	Inland Empire	50
GF02	Brickell (1970)	Inland Empire	50
GF03	Cochran (1979b)	eastern WA, eastern OR	50
LODGEPOLE PINE:			
LP01	Alexander (1966)	CO,WY,UT,ID,MT, eastern WA, eastern OR	100
LP02	Brickell (1970)	CO,WY,UT,ID,MT, eastern WA, eastern OR	50
LP03	Kirby (1975)	Alberta	70
LP04	Hegyi and others (1981)	BC	50
LP05	Hegyi and others (1981)	BC	100
PONDEROSA PINE:			
PP01	Meyer (1938)	CA,OR,WA,ID,MT,SD	100
PP02	Lynch (1958)	northern ID, WA, MT	100
PP03	Brickell (1970)	northern ID, WA, MT	50
PP04	Barrett (1978)	eastern WA, eastern OR	100
PP05	Summerfield (1980b)	eastern WA	50
PP06	Tesch and others (1980)	western MT	50
PP07	Hegyi and others (1981)	BC	50
PP08	Hegyi and others (1981)	BC	100
WESTERN HEMLOCK:			
WH01	Barnes (1962)	western OR, western WA, western BC, AK	100
WH02	Wiley (1978)	western WA, western OR, western BC	50
WH03	Hegyi and others (1981)	BC	50
WH04	Hegyi and others (1981)	BC	100
WESTERN LARCH:			
WL01	Brickell (1970)	western MT, northern ID	50
WL02	Schmidt and others (1976)	western MT, northern ID	50
WL03	Hegyi and others (1981)	BC	50
WL04	Hegyi and others (1981)	BC	100
WESTERN WHITE PINE:			
WP01	Haig (1932)	northern ID	50
WP02	Deitschman & Green (1965)	northern ID	50
WP03	Brickell (1970)	northern ID	50
WL04	Hegyi and others (1981)	BC	50
WL05	Hegyi and others (1981)	BC	100
WESTERN RED CEDAR:			
RC01	Hegyi and others (1981)	BC	50
RC02	Hegyi and others (1981)	BC	100

APPENDIX D: CROWN CLASS, TREE STATUS, AND TREE CLASS CODES

Crown Class Codes

Enter the most applicable crown class code from the list below. The codes are from Curtis (1983) with some minor modifications.

(0) No estimate
(1) Dominant
(2) Codominant
(3) Intermediate
(4) Suppressed
(5) Understory
(6) Overstory
(7) Open-grown
(8) Shrub form
(9) Off-plot tree

Tree Status Codes

Enter the most applicable tree status code from the list below. The codes are from Curtis (1983) with some minor modifications.

(0) Live
(1) Cut
(2) Dead
(3) Code reserved for future use
(4) Code reserved for future use
(5) Code reserved for future use
(6) Code reserved for future use
(7) Both site and crop tree
(8) Site tree
(9) Crop tree

It is assumed that the tree is alive when codes 7, 8, and 9 are used.

Tree Class Codes

Enter the most applicable tree class code from the list below. The codes are from Curtis (1983) with some minor modifications.

(0) No designation
(1) Code reserved for future use
(2) Code reserved for future use
(3) Ingrowth (tree too small to be measured at previous exam)
(4) Not previously measured but not ingrowth
(5) Could not locate at this measurement; presumed to be dead
(6) Live tree with measured height not suitable for height from d.b.h. regressions
(7) Code reserved for future use
(8) Code reserved for future use
(9) Code reserved for future use

APPENDIX E: TREE CONDITION (DAMAGE) CODES

The tree condition codes are hierarchical. The code is a two-digit numeric code. The first number is the generalized tree condition category. This first number is followed by a second number representing one of the subcodes from the group. For example, unknown treatment damage is recorded as "10". This coding system could easily be expanded to a third level with even more specific information. The basis for these codes is Curtis (1983). His original system was modified slightly to reflect additional damage codes that are important in the Intermountain Northwest.

Record type 820 (Individual tree measurements) allows the user to record up to three tree condition codes per tree, with the associated severity and location of damage codes (appendix F) for each tree condition code. Many times a tree has more than one type of damage but it is difficult to prioritize the damage. It is not necessary to assign tree conditions codes with any priority.

(0) No damage
(1) Treatment damage
  (0) Unknown or unspecified damage
  (1) Logging (basal wounds or top damage)
  (2) Foliar treatments (broadcast chemical)
  (3) Stem treatments (spot chemical)
  (4) Root or soil treatments
  (5) Pruning
(2) Crown diseases
  (0) Unknown or unspecified crown disease
  (1) Unhealthy appearance
  (2) Mistletoe
  (3) Needle rusts
(3) Stem diseases
  (0) Unknown or unspecified stem disease
  (1) Stem decays
  (4) Stem rusts
  (7) Stem cankers
(4) Root diseases
  (0) Unknown or unspecified root disease
  (1) *Armillaria mellea*
  (2) *Phellinus weirii*
(5) Insects
  (0) Unknown or unspecified
  (1) Defoliators
  (4) Bark beetles
(6) Animals
  (0) Unknown or unspecified
  (1) Deer or elk
  (2) Bear
  (3) Livestock
  (4) Porcupine
  (5) Mountain beaver
  (6) Other small mammals
  (7) Birds
(7) Weather
  (0) Unspecified
  (1) Windthrow, stem breakage, or down tree
  (2) Snow or ice (bending, breakage, or bole cracks)
  (3) Freezing
  (4) Moisture deficiency (drought or heat caused)
  (5) Winter dessication (red belt)
  (6) Sunscald
  (7) Lightning
(8) Physical defects
  (0) Unspecified
  (1) Broken or missing top
  (2) Dead top
  (3) Forked tree
  (4) Multiple tops
  (5) Leaning or bent tree
  (6) Crook or sweep
  (7) Checks or bole cracks
  (8) Epicormic branching
(9) General categories and miscellaneous
  (0) Unknown or unspecified damage
  (1) Suppression
  (2) Fire
  (3) Disease (unknown or unspecified)

APPENDIX F: SEVERITY AND LOCATION OF DAMAGE

Severity of Damage

The severity of damage codes are applicable only if a tree condition code or location of damage code has been specified. In general, severity is directly proportional to the amount of damage done to any single component of the tree. This component can be identified by using the location of damage codes and/or the tree condition codes. These severity of damage codes combine the coding schemes provided by Arney and Curtis (1977) and Curtis (1983), with some minor modifications.

(0) Unspecified
(1) 0 to 20 percent of component damaged
(2) 21 to 40 percent of component damaged
(3) 41 to 60 percent of component damaged
(4) 61 to 80 percent of component damaged
(5) 81 to 100 percent of component damaged

The following codes are more specific since these tree condition codes do not lend themselves to a severity index scaled in percent.

Leaning or bent tree (corresponding tree condition code: 85)
(1) <25-degree angle
(2) 26-45 degree angle
(3) >45-degree angle
(4) down tree

Broken top, dead top, or forked tree (corresponding tree condition codes: 81, 82, or 83)

(1) Forked below breast height
(2) Forked above breast height, but below first 17 feet (5.2 m)
(3) Forked top
(4) Dead or broken top with no new leader from a lateral branch (single dead or broken top)
(5) Dead or broken top with new leader from a lateral branch

Location of Damage

The location of damage codes allow for designating where on the tree the damage has occurred, if recorded. This location code corresponds to the tree condition code entered from appendix E. These codes are from Curtis (1983).

(0) No damage or no information
(1) Damage present, location unspecified
(2) Top damage
(3) Foliar (crown) damage
(4) Limb damage
(5) Bole damage other than top or basal
(6) Basal
(7) Roots

APPENDIX G: COMPARISON TO OTHER STANDARDIZED FORMATS

The following table summarizes the field formats for the data structure presented in this report, titled as the "INGY format", the U.S. version of the COSMADS formats (Hegyi 1985), and PNW's PDMS System (Curtis and Clendenen 1981). Given slight differences in definitions of some fields, every attempt was made to present a legitimate comparison.

Field name	INGY Format	U.S. COSMADS Format	PNW PDMS Format
Plot identification:			
Source	N2	—	—
Installation	N4	N3	N4
Stand	N2	—	—
Plot	N4	N4	N4
Subplot	N2	—	N2
110. Sampling design:			
Subpopulation number	N1	—	—
1st characteristic	C1	—	—
Min. limit for 1st char.	C5	—	N3
Max. limit for 1st char.	C5	—	—
2nd characteristic	C1	—	—
Min. limit for 2nd char.	C5	—	—
Max. limit for 2nd char.	C5	—	—
Sampling rule number	N1	—	—
Var. defining probability	C3	—	—
Expansion factor	N9.4	N5.4	N5
Total number of samples	N2	—	—
Unit of measure	C1	—	C1
Number of prism points	—	—	N2
Basal area factor	—	—	N3
Number of concentric plots	—	—	N1
Area of each concentric plot	—	—	N5
210. Administrative descriptors			
Project name	C25	C4	C4
Stand name	C25	C14	—
Stand administrator	C3	—	C3
Stand owner	C3	C3	C3
Common name of study	—	—	C10
220. Location descriptors			
State/Province	C2	C2	C2
Latitude (degrees)	N3	N3	N3
Latitude (minutes)	N2	N2	N2
Latitude (seconds)	N5.2	—	—
Longitude (degrees)	N3	N3	N3
Longitude (minutes)	N2	N2	N2
Longitude (seconds)	N5.2	—	—
UTM zone	N2	—	C2
UTM easting	N6	—	C6
UTM northing	N7	—	C7
Grid type code	N1	—	C4
Grid type description	C20	—	C20

Field name	INGY Format	U.S. COSMADS Format	PNW PDMS Format
Grid type 1 (U.S.)			
Nearest forty	C4	C4	C4
Section number	C2	N2	C2
Range	C3	C3	C3
Half-range	C1	—	C1
Township	C3	C3	C3
Half-township	C1	—	C1
Base meridian	C2	—	C2
310. Plot descriptors			
Plot status	C1	C1	C1
Comment flag	C1	N1	—
Treatment code	C4	C2	N1
Stand origin	C1	C1	C1
Primary species	C2	C2	N3
Secondary species	C2	C2	N3
Breast-height age, primary	N3	N3	N3
Breast-height age, secondary	N3	—	N3
Total age, primary	N3	N3	N3
Total age, secondary	N3	—	N3
1st site index species	C2	—	N3
Site index for 1st species	N3	N3	N3
Reference for 1st species	C4	C1	C2
Methodology, 1st species	N1	—	—
2nd site index species	C2	—	N3
Site index for 2nd species	N3	—	N3
Reference for 2nd species	C4	—	C2
Methodology, 2nd species	N1	—	—
Plot buffer	C1	—	—
Average width of buffer	N5.1	—	—
Subpopulation/sampling rule	N2	—	—
Measurement number	N2	—	—
1st change in sampling design	N2	—	—
Measurement no. for change	N2	—	—
Plot shape	—	C2	C2
Stem map	—	C1	C1
320. Plot summary descriptors			
Measurement number	N2	—	—
Species code	C2	—	—
Trees/unit area	N6	—	N4
Quadratic mean diameter	N4.1	—	—
Total basal area/unit area	N5.1	—	—
Top height	N5.1	—	—
410. Measurement dates			
Measurement number	N2	—	—
Measurement year	N4	N2	—
Measurement month	N2	N2	—
Measurement day	N2	N2	—
Measurement date	—	—	C8

Field name	INGY Format	U.S. COSMADS Format	PNW PDMS Format
510. Treatment descriptors			
Treatment number	N2	—	—
Year of treatment	N4	N2	—
Month of treatment	N2	N2	—
Day of treatment	N2	N2	—
Prior stand alteration	C1	—	—
Treatment class	C1	—	—
Treatment type	C2	—	N2
Chemical brush type	—	—	C1
Method of thinning	—	—	C1
Method of brush control	—	—	C1
610. Site descriptors			
Elevation	N5	N2	N4
Aspect	N3	N3	N3
Slope	N3	N3	N3
Position	N1	N1	N1
Soil site index species	C2	—	—
Soil site index	N3	—	—
Soil site index reference	C4	—	—
Bioclimatic zone	C30	—	C14
Classification system	C7	—	C1
Blocking ridge data	—	—	C1
230. Administrative units			
Forest (Farm)	C5	—	—
District	C5	—	—
Compartment	C5	—	—
Timber unit (stand)	C5	—	—
Additional information	C43	—	—
520. Fertilization treatments			
Treatment number	N2	—	—
Source of nutrient	C35	—	N1
Application rate of N	N3	N3	N3
Application rate of P	N3	N3	N3
Application rate of K	N3	N3	N3
Application rate of S	N3	N3	N3
Application of micronutrients	N3	N3	N3
Fertilization method	—	—	C1
620. Soil Descriptors			
Soil profile description	C1	—	C1
Physical soil description	C1	—	C1
Chemical soil description	C1	—	C1
Rooting depth	N4.1	N2	N3
Texture of soil	C4	—	C4
Coarse fragments	N2	—	N2
Drainage class	N1	—	N1
Soil series	—	—	C12

Field name	INGY Format	U.S. COSMADS Format	PNW PDMS Format
630. Climatic descriptors			
Annual precipitation	N3	N3	N3
Growing season precipitation	N3	N3	N3
Mean growing season temp.	N3	N3	N3
Degree days	N5	N5	N4
Frost-free days	N3	N3	N3
Solar radiation	—	N4	—
Evapotranspiration deficit	—	N4	—
Classification year	—	N2	—
Classification month	—	N2	—
Classification day	—	N2	—
710. Height from d.b.h. regression			
Measurement number	N2	—	—
Species code	C2	—	—
Continuation number	N1	—	—
Equation form	C55	—	—
810. Individual tree descriptors			
Tree number	N4	N4	N4
Species code	C2	C2	N3
Breast-height age	N3	N3	N3
Total age	N3	—	—
X-coordinate	N7.2	N4.1	N4
Y-coordinate	N7.2	N4.1	N4
Bearing from plot center	N3	—	—
Distance from plot center	N6.2	—	—
Number of replicates	N5	—	N4
Number of measurements	N2	N2	N2
Age precision code	—	—	N1
820. Individual tree measurements			
Tree number	N4	N4	N4
Measurement number	N2	N2	—
Diameter at breast-height	N5.1	N4.2	N4
Diameter precision code	N1	—	N1
Total height	N6.2	N4.1	N4
Height precision code	N1	—	N1
Percent live crown	N3	—	—
Live crown precision code	N1	—	N1
Crown class	N1	N1	N1
Tree status	N1	N1	N1
Tree class	N1	N1	N1
Tree condition code 1	N2	N1	N2
Severity of damage code 1	N1	—	N1
Location of damage code 1	N1	—	N1
Tree condition code 2	N2	—	—
Severity of damage code 2	N1	—	—
Location of damage code 2	N1	—	—
Tree condition code 3	N2	—	—

Field name	INGY Format	U.S. COSMADS Format	PNW PDMS Format
820. Individual tree measurements (Con.)			
Severity of damage code 3	N1	—	—
Location of damage code 3	N1	—	—
Radial-growth increment	N4.2	—	—
Radial-growth interval	N2	—	—
Height to live crown	—	N3	N3
Volume	—	—	N4
900. Comments			
Continuation number	N2	N1	N2
(Blank)	C1	—	—
Comments	C60	C70	C65
910. Individual Tree Comments			
Tree Number	N4	—	—
Measurement Number	N2	—	—
Continuation Number	N2	—	—
(Blank)	C1	—	—
Comments	C50	—	—
Physical soil description			
Soil depth for forest floor	—	N2	—
Soil depth A horizon	—	N2	—
Soil depth without rock	—	N2	—
Total soil depth	—	N2	—
Bulk density	—	N5.4	—
Surface sand percent	—	N3	—
Surface silt percent	—	N3	—
Surface clay percent	—	N3	—
Sub-surface sand percent	—	N3	—
Sub-surface silt percent	—	N3	—
Sub-surface clay percent	—	N3	—
Soil series name	—	C5	—
Landform code	—	C2	—
Parent material	—	C2	—
Soil great group	—	C3	—
Analysis location code	—	C3	—
Source	—	C16	—
Classification year	—	N2	—
Classification month	—	N2	—
Classification day	—	N2	—
Chemical soil description			
Organic matter in A horizon	—	N6	—
Nitrogen in A horizon	—	N6	—
Phosphorus in A horizon	—	N6	—
Potassium in A horizon	—	N6	—
Sulphur in A horizon	—	N6	—
Calcium in A horizon	—	N6	—
Magnesium in A horizon	—	N6	—
Nitrogen in A soil	—	N6	—
Phosphorus in soil	—	N6	—

Field name	INGY Format	U.S. COSMADS Format	PNW PDMS Format
Chemical soil description (Con.)			
Potassium in soil	—	N6	—
Sulphur in soil	—	N6	—
Calcium in soil	—	N6	—
Magnesium in soil	—	N6	—
Surface pH	—	N2.1	—
Sub-surface pH	—	N2.1	—
Stem mapping			
Stem map *y*-azimuth	—	N4	—
Post #1, *X*-coordinate	—	N4.1	—
Post #1, *Y*-coordinate	—	N4.1	—
Post #2, *X*-coordinate	—	N4.1	—
Post #2, *Y*-coordinate	—	N4.1	—
Post #3, *X*-coordinate	—	N4.1	—
Post #3, *Y*-coordinate	—	N4.1	—
Post #4, *X*-coordinate	—	N4.1	—
Post #4, *Y*-coordinate	—	N4.1	—
Circular plot radius	—	F4.1	—
Length of plot along *X*	—	F4.1	—
Length of plot along *Y*	—	F4.1	—
Type of stem mapping	—	C16	—
Year of stem mapping	—	N2	—
Month of stem mapping	—	N2	—
Day of stem mapping	—	N2	—

APPENDIX H: EXAMPLE RECORDS FROM A SAMPLE PLOT

This is an example of how various record types would be completed for installation 478, stand number 1 (see sampling design examples).

```
1 478 1  0 01101D1.5  99.9            1FRQ   5.0000 3E
1 478 1  0 01102D0.1  1.4             1FRQ 300.0000 3E
1 478 1  0 0210UM-MORP Project No. 24   Section 12 Lodgepole PineUMTUMT
1 478 1  0 0220MT 465339.001132629.9012313980519612O1NESW1215WN13NNPR
1 478 1  1 0310ANCTRLNLP   50  0 54  0LP 54LP022    0    0Y 50.011 1 0 0
1 478 1  1 1310ANCTRLNLP    0  0  0  0LP 54LP022    0    0Y 17.012 1 0 0
1 478 1  2 0310ANCTRLNLP   50  0 54  0LP 54LP022    0    0Y 50.011 1 0 0
1 478 1  2 1310ANCTRLNLP    0  0  0  0LP 54LP022    0    0Y 17.012 1 0 0
1 478 1  3 0310ANCTRLNLP   50  0 54  0LP 54LP022    0    0Y 50.011 1 0 0
1 478 1  3 1310ANCTRLNLP    0  0  0  0LP 54LP022    0    0Y 17.012 1 0 0
1 478 1  1 0320 1LP   808 5.9  0.0 57.3
1 478 1  1 1320 1LP     3 1.1  0.0  0.0
1 478 1  1 0320 199   811 5.9153.9 57.3
1 478 1  2 0320 1LP   800 6.1  0.0 58.9
1 478 1  2 1320 1LP     4 1.0  0.0  0.0
1 478 1  2 0320 199   804 6.1163.2 58.9
1 478 1  3 0320 1LP   796 6.1  0.0 57.7
1 478 1  3 1320 1LP     2 1.1  0.0  0.0
1 478 1  3 0320 199   798 6.1161.9 57.7
1 478 1  1 0410 11983 915
1 478 1  1 1410 11983 915
1 478 1  2 0410 11983 915
1 478 1  2 1410 11983 915
1 478 1  3 0410 11983 917
1 478 1  3 1410 11983 917
1 478 1  0 0510 11983 9 0NUUT
1 478 1  1 0610 4120341  85    0    PSME/VACA                    PFIST77
1 478 1  1 1610 4120341  85    0    PSME/VACA                    PFIST77
1 478 1  2 0610 4140  6  95    0    PSME/VACA                    PFIST77
1 478 1  2 1610 4140  6  95    0    PSME/VACA                    PFIST77
1 478 1  3 0610 4135 35 115    0    PSME/VACA                    PFIST77
1 478 1  3 1610 4135 35 115    0    PSME/VACA                    PFIST77
1 478 1  0 0620YYN 3.0SICL152
1 478 1  0 0710 1LP14.3 + 8.6758 * DBH
1 478 1  1 0810   1LP  0  0   0.00   0.00  0  0.00    1 1
1 478 1  1 0810   2LP  0  0   0.00   0.00  0  0.00    1 1
1 478 1  1 0810   3LP  0  0   0.00   0.00  0  0.00    1 1
1 478 1  1 0810   4LP 46 53   0.00   0.00  0  0.00    1 1
1 478 1  1 0810   5LP 47 54   0.00   0.00  0  0.00    1 1
1 478 1  1 1810   1LP  0  0   0.00   0.00  0  0.00    1 1
1 478 1  1 0820   1 1  5.11 47.603 382000 000 000 0000.00 0
1 478 1  1 0820   2 1  5.31 48.103 432000 000 000 0000.00 0
1 478 1  1 0820   3 1  7.31 53.203 452000 000 000 0000.00 0
1 478 1  1 0820   4 1  6.71 54.303 582070 000 000 0000.23 5
1 478 1  1 0820   5 1  7.21 53.603 552070 000 000 0000.18 5
1 478 1  1 1820   1 1  1.11 19.203 2220068510 000 0000.00 0
1 478 1  0 0900 1 This is an example of how various record types would be
1 478 1  0 0900 2 completed for installation 478, stand number 1 (see sampling
1 478 1  0 0900 3 design examples). Only a partial tree list is shown for plot
1 478 1  0 0900 4 number 1, and subplot number 1 of plot 1.  Supplemental
1 478 1  0 0900 5 record types 230, 520, 630, and 910 were not used.
```


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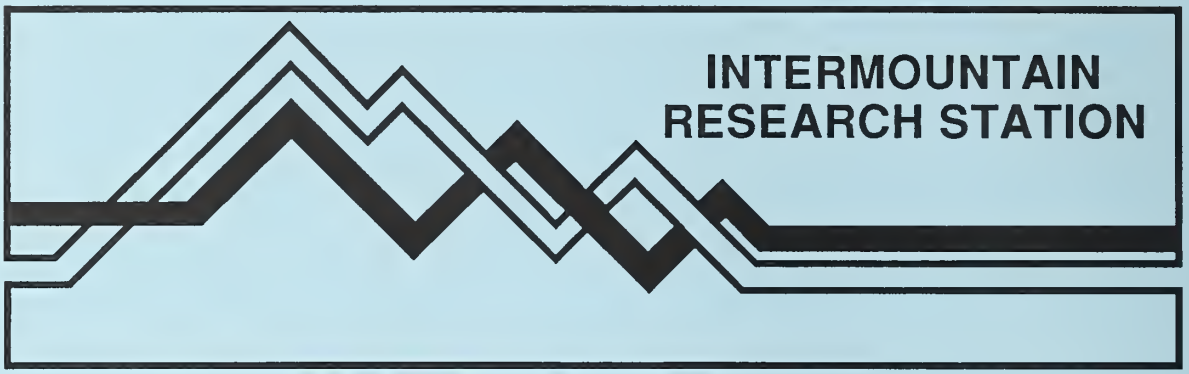
Sweet, Michael D.; Byrne, John C. 1990. A standardized data structure for describing and exchanging data from remeasured growth and yield plots. Gen. Tech. Rep. INT-271. Ogden, UT: U.S. Department of Agriculture, Forest Service, Intermountain Research Station. 43 p.

Proposes standard data definitions and format to facilitate the sharing of growth and yield permanent plot data for the development, testing, and improvement of tree or stand growth models. The data structure presented provides standards for documenting sampling design, plot location and summary descriptors, measurement dates, treatments, site attributes, and individual tree characteristics. Standardized species, crown class, tree class, and tree condition codes are defined for use in the Intermountain Northwest.

KEYWORDS: data management systems, timber management, mensuration



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